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Grazing by reindeer in subarctic coniferous forests – how it is affecting three main greenhouse gas emissions from soils.

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Reindeer (*Rangifer tarandus* L.) are the most important large mammalian herbivores in the northern ecosystems, strongly affecting Arctic lichen dominated ecosystems. Changes caused by reindeer in vegetation have indirect effects on physical features of the soil e.g. soil microclimate, root biomass and also on soil carbon dynamics, and little is known about reindeer and their impact on greenhouse gas (GHG) emissions between the soil and atmosphere.

In a field experiment in northern boreal subarctic coniferous forests in Finnish Lapland, we investigated the influence of reindeer grazing on soil GHG (CO_2, CH_4 and N_2O) fluxes, ground vegetation coverage and biomass, soil temperature and water content. The study was carried out in the growing season of the year 2014. We established the experiment as a split plot experiment with 2 blocks and 5 sub-plots per treatment that were divided into grazed and non-grazed parts, separated with a fence. The sample plots are located along the borderline between Finland and Russia, where the non-grazed area was excluded from reindeer already in 1918, to prevent the Finnish reindeer from going to the Russian side and there are not many reindeer on Russian side of the area.

Our study showed that grazing by reindeer significantly affected lichen and moss biomasses. Lichen biomass was significantly lower in the grazed. We also observed that when lichens were removed, mosses were quickly overtaking the areas and moss biomass was significantly higher in grazed areas compared to non-grazed areas. Our results indicated that grazing by reindeer in the northern boreal subarctic forests affects the GHG emissions from the forest floor and these emissions largely depend on changes in vegetation composition. Soil was always a source of CO_2in our study, and soil CO_2 emissions were significantly smaller in non-grazed areas compared to grazed areas. The soils in our study areas were CH_4 sinks through entire measurement period, and grazed areas consumed more CH_4 compared to non-grazed areas. We also observed that the N_2O emissions were significantly affected by moss biomass and soil temperature. Non-grazed areas with lower moss biomass and soil temperature were a small sink of N_2O while the total fluxes remained around zero in the grazed areas.